CELLOSIZE® HEC THICKENERS For Textile Coatings, Binders, And Adhesives

CELLOSIZE® Hydroxyethyl Cellulose (HEC) is a nonionic, water-soluble polymer that has the ability to thicken, stabilize, and aid in controlling the film-forming properties of latex-based formulations used as textile coatings, binders, and adhesives. CELLOSIZE HEC may be further described as a nonionic hydrocolloid and is available in a wide range of viscosity grades.

CELLOSIZE HEC is stable in solution with high concentrations of salts and may, therefore, be formulated in latex systems containing such additives as borates, silicates, and carbonates. Solutions of high-viscosity grades thin out under shear; they are pseudoplastic. This property is very useful in formulating textile coatings and adhesives. The pseudoplasticity imparted by CELLOSIZE HEC permits smooth, uniform application of the coating or adhesive (even when the viscosities are very high) and helps improve print definition in print flocking or coating holdout on open fabrics. Because it is a hydrocolloid, CELLOSIZE HEC helps to control the rate of water release in a latex-based coating or adhesive. As a result, high-solids formulations can still maintain good film formation and open time. In low-solids formulations, such as some nonwoven binder systems, CELLOSIZE HEC helps stabilize the formulation. The longer open time results in excellent roll lubrication and improved fabric release from the roll, thus noticeably reducing the pilling problems often encountered in processing nonwoven fabrics.

CELLOSIZE HEC is provided in an easy handling, dry, granular form. This form facilitates storage and physical handling but requires precautions when adding to a water-based formulation. Because it is hygroscopic, hydroxyethyl cellulose should be added slowly through a fine screen and with good agitation (moderate shear). However, addition can be simplified by using one of several easily accomplished techniques.

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HOW TO ADD HEC

(1) Preslurry in Water

CELLOSIZE HEC QP grades do not hydrate as quickly as the WP grades and, as a result, may be preslurried in water. This slurry can then be easily added to a latex-based formulation without lumping. The slurry should be added to the latex system while both are under acidic pH conditions. For best results and longest handling times, the water used in slurrying CELLOSIZE HEC should be cold, at a pH of 5 to 7, and present in sufficient quantity to give a very fluid slurry (at least 10 parts of water per 1 part of CELLOSIZE HEC). The slurry should be added immediately to the latex (< 5 minutes). Unless very good agitation with moderate shear is available, let the solution of CELLOSIZE HEC complete its thickening while the system is acidic (preferably < 4). With textile adhesives (where acid catalysts are used), thickening generally requires 30 to 45 minutes, depending on the degree of shear and agitation available. The pH of the system should not be increased until the original grainy appearance has disappeared and the compound has become smooth and glossy. If the pH is raised prior to this point, some lumping can occur.

(2) Preslurry in Plasticizer or Nonpolar Organic Liquids

Probably the easiest way to handle CELLOSIZE HEC in the compounding of textile coatings, binders, and adhesives is a preslurry in a plasticizer or a nonpolar organic liquid. The slurry should contain 5 parts or more of plasticizer to 1 part of CELLOSIZE HEC (4:1 may be used if good agitation is available). Since the hydroxyethyl cellulose is not noticeably soluble in the nonpolar plasticizer, the slurry will remain fluid and easy to pour for an almost indefinite period. CELLOSIZE HEC will settle if no agitation is used, but it is easily redispersed.

This slurry can be added directly and quickly to a latex system under moderate agitation without difficulty. It is advisable that the pH of the latex system be acidic or neutral. After the slurry is added and well dispersed (about 5 to 10 minutes) in the latex system, the pH of the system may be raised without causing lumps to form. Under these conditions, thickening is rapidly and smoothly accomplished.

(3) Pre-solubilization with Polar Organic Solvents

CELLOSIZE HEC may be pre-solubilized by mixing it with a polar organic liquid such as ethylene glycol. CELLOSIZE HEC does not thicken as much in this type of solvent as in water and may, therefore, be handled in a more concentrated solution. The ratio of solvent to CELLOSIZE HEC required for easy handling varies with the molecular weight of CELLOSIZE HEC (higher molecular weights require more solvent). A level of 8 to 9 parts of ethylene glycol for 1 part of CELLOSIZE HEC QP-300H will give a pourable system that thickens very rapidly and smoothly when added under good agitation to a latex system with a pH of 8.0.

CELLOSIZE® HEC THICKENERS IN NONWOVENS

Since many of the binder applications are based on roll metering and application, the water-holding properties of CELLOSIZE HEC are particularly advantagous. CELLOSIZE HEC helps obtain proper roll lubrication and prevent buildup of binder on the application rolls. Good roll lubrication and controlled wet film-splitting properties are the keys to minimizing pilling in nonwoven fabrics. In addition, the use of low molecular weight grades (such as WP-09L), at about 0.25 to 0.50 per cent on latex solids, are useful in improving wet strength through better film formation.

CELLOSIZE® HEC THICKENERS IN BACKCOATINGS

CELLOSIZE HEC is preferred over acrylic thickeners in many systems because of faster and more uniform drying, better control of strikethrough, and improved dye acceptance. It is sometimes used in combination with acrylic thickeners to obtain a desired rheology.

Many backcoating systems are mechanically frothed to obtain certain desired properties, such as increased hiding and reduced add-on. CELLOSIZE HEC thickeners perform nicely in frothed latex systems. They impart the type of rheology desired for frothing and contribute noticeably to the foam stability of the frothed product. This increased stability greatly reduces the chance of foam collapse and cracking of the coating during drying.

CELLOSIZE® HEC THICKENERS IN FLOCKING ADHESIVES

CELLOSIZE HEC thickeners are particularly effective in the area of flock adhesive formulating. Adhesives prepared with CELLOSIZE HEC thickeners offer the longer open times, controlled water release, and better runability required to obtain the desired flock density with trouble-free running on high speed, modern flocking lines. The wide range of viscosity grades available in CELLOSIZE HEC enables the adhesive chemist to not only formulate a desired viscosity level, but to also exercise control over open time, water-release rates, and polymer film-forming characteristics (by controlling the level of water-soluble material). Surfactants increase the tendency to skin (decrease the open time). For maximum control of skinning, the adhesive chemist should use surfactant-free latexes (such as UCAR Latexes 872, 874, or 878) with CELLOSIZE HEC thickeners. This is particularly true in the case of print flocking. The combination of CELLOSIZE HEC thickeners and surfactant-free latexes provides the most trouble-free systems.

TABLE 1 FORMULATION Throw rug backcoating UCAR® Latex 803

Ingredients	Parts by Weight Dry	As Received
Water	—	358.1
CELLOSIZE® Hydroxyethyl Cellulose (HEC) QP-5200H	5.0	5.0
Hydrated Alumina, RH31F	200.0	200.0
UCAR Latex 803	100.0	188.0
Ammonium Hydroxide, 28% Aqueous Solution	—	2.0
Total	305.0	753.1
Total Solids, % by wt.		40.5
pH		8.4
Viscosity (Brookfield Model RVT, No. 4 Spindle, 20 rpm), cP		6000

Procedure

Combine the ingredients in the order listed with good agitation. Continue stirring until the mix has a smooth appearance, indicating complete dissolution of CELLOSIZE HEC. Polypropylene glycol 2025 may be added as an antifoam if necessary.

TABLE 2 FORMULATION Polypropylene upholstery backcoating UCAR® Latex 865

Ingredients	Parts by Weight Dry	As Received
Water	—	18.68
CELLOSIZE Hydroxyethyl Cellulose (HEC) QP-5200H	0.29	0.29
UCAR Latex 865	30.73	55.88
"Tamol" 731	0.21	0.84
"Emcol" 10C	0.01	0.08
Hydrated Alumina	7.58	7.58
Calcium Carbonate	7.58	7.58
"Fyrol" FR2	8.37	8.37
Ammonium Hydroxide, 28% Aqueous Solution	—	0.70
Total	54.77	100.00
Total Solids, % by wt.		54.8
pH		9.5
Viscosity (Brookfield Model RVT, No. 6 Spindle, 20 rpm), cP		9000

Procedure

Combine the ingredients in the order listed with good agitation.

TABLE 3 FORMULATION Foam saturation for bonding nonwoven fabrics UCAR® Latex 874

Ingredients	Parts by Weight Dry	As Received
UCAR Latex 874	35.40	60.00
Water	—	30.00
CELLOSIZE Hydroxyethyl Cellulose (HEC) QP-4400H, 4% Aqueous Solution	0.24	6.00
"Aerosol" 18	1.12	3.20
"Sipex" UB	0.24	0.80
Total	37.00	100.00
Total Solids, % by wt.		37
pH		4.5
Viscosity (Brookfield Model RVT, No. 1 Spindle, 50 rpm), cP		21

Procedure

Combine the ingredients in the order listed with good agitation.

TABLE 4 FORMULATION Overall flock adhesive UCAR® Latex 878

Ingredients	Parts by Weight Dry	As Received
Water	—	19.61
UCAR Latex 878	36.68	73.36
CELLOSIZE Hydroxyethyl Cellulose (HEC) QP-5200H	0.60	0.60
Polypropylene Glycol 2025	0.07	0.07
FLEXOL Plasticizer TOF	1.83	1.83
Oxalic Acid, 10% Aqueous Solution	0.20	2.04
Ammonium Hydroxide, 28% Aqueous Solution	—	1.01
"Paragum" 109	0.26	0.75
"Cymel" 301	0.73	0.73
Total	40.37	100.00
Total Solids, % by wt.		40.4
pH		7.9
Viscosity (Brookfield Model RVT, No. 6 Spindle, 20 rpm), cP		14,000

Procedure

Disperse CELLOSIZE HEC in FLEXOL Plasticizer TOF and add to UCAR Latex 878. Add polypropylene glycol 2025 to control foaming. Add the oxalic acid solution and allow the mixture to blend until smooth (about 20 to 30 minutes). Then add the ammonium hydroxide, "Paragum" 109, and "Cymel" 301 in the order listed.

GRADES AND TYPES

CELLOSIZE Hydroxyethyl Cellulose (HEC) is manufactured in ten standard viscosity grades to meet the demands required by many different applications. The grades differ principally in their aqueous solution viscosities, which range from two to almost 200,000 centipoises at two percent concentration. This wide range of grades, combined with availability of Low (L) and High (H) viscosity ranges, permit a precise selection of material and a superior reproducibility of end product.

Two types are produced: A WP-type, which is a normal dissolving material, and a QP-type, which is a rapid dispersing material. Three viscosity grades (09, 3, and 300) are produced in both WP- and QP-types. Seven high viscosity grades (40; 4400; 10,000; 15,000; 30,000; 52,000; and 100M) are produced only in the QP-type.

Table 5 shows the standard grades and types commercially available, and their respective viscosity ranges in aqueous solution.

In ordering CELLOSIZE HEC, specify the following information:

1. Type desired — normal dissolving (WP-type) or rapid dispersing (QP-type)
2. Viscosity grade — 09, 40, 300, etc.
3. Viscosity range — L for low, H for high

EXAMPLE: If a rapid dispersing CELLOSIZE Hydroxyethyl Cellulose with a viscosity of about 350 is desired, specify CELLOSIZE Hydroxyethyl Cellulose QP-300-H.

FDA AND EPA STATUS

CELLOSIZE Hydroxyethyl Cellulose (HEC) is presently approved under regulations of the United States Food and Drug Administration (FDA), for use in indirect food applications such as food-packaging adhesives and can and paper coatings. CELLOSIZE HEC has not been cleared for direct use as a component of food products.

Under regulations of the Environmental Protective Agency (EPA), CELLOSIZE HEC is exempt from the requirement of a residue tolerance when used as an inert ingredient in pesticide formulations.

FDA Regulations	*Use*
121.2514	Component of resinous and polymeric coatings applied as a continuous film over metal or any substrate suitable for repeated use.
121.2520	Component of food-packaging adhesives.
121.2526 121.2571	Component of the coated or uncoated food contact surface of paper and paperboard in contact with fatty, aqueous and dry foods.
121.102	Exempt from the requirement of a residue tolerance when used as an adjuvant added to pesticide use dilutions by a grower or applicator prior to application to the raw agricultural commodity.

EPA Regulation	*Use*
180.1001 (c)	Exempt from the requirement of a residue tolerance when used as an inert ingredient in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest.

TABLE 5
CELLOSIZE® Hydroxyethyl Cellulose (HEC) viscosity ranges of aqueous solutions

HEC Type	Viscosity Grade	Concentration, % by Weight on Dry Basis	Viscosity Range at 25°C Brookfield LVT Viscometer, cP		Spindle No.	RPM
WP			L Range	H Range		
	09	5	75 to 112	113 to 150	1	60
	3	5	215 to 282	283 to 350	2	60
	300	2	250 to 324	325 to 400	2	60
QP						
	09	5	75 to 112	113 to 150	1	30
	3	5	215 to 282	—	2	60
	40	2	80 to 112	113 to 145	1	30
	300	2	250 to 324	325 to 400	2	60
	4400	2		4800 to 5600	4	60
	10,000	2		6000 to 7000	4	60
	15,000	1		1100 to 1450	3	30
	30,000	1		1500 to 1900	3	30
	52,000	1		2400 to 3000	3	30
	100M	1		4000 to 5200	4	30

TABLE 6
TYPICAL PROPERTIES OF CELLOSIZE® Hydroxyethyl Cellulose (HEC)

Ash Content as Na_2CO_3	3.5% by wt
Apparent Density	22 to 38 lb per cu. ft.
Color	Cream to white
Decomposition Temperature	Approximately 400°F
Particle Size	Through U.S. 80 mesh
Softening Point	>285°F
Specific Gravity at 20/20°C	1.38 to 1.40
Volatile Matter	<5% by wt
Bulking Value	11 lb per gallon

FIGURE I
Effect of pH on dissolving characteristics of QP-type

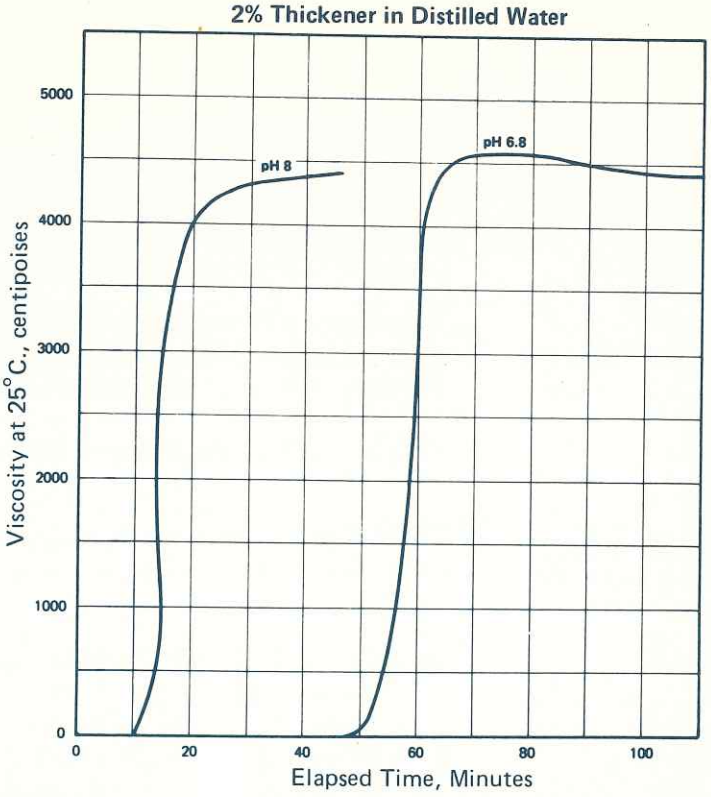
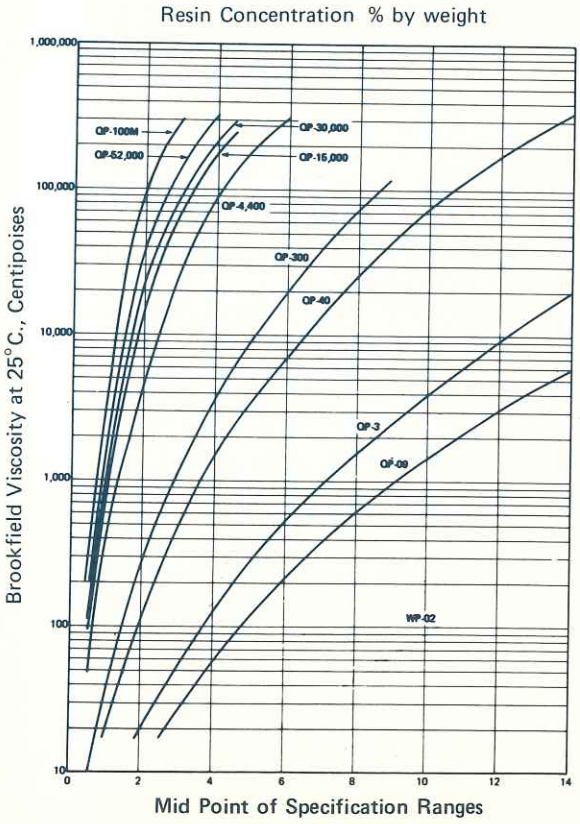


FIGURE II
Typical effect of concentration on viscosity



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